इंटरनेट मानक

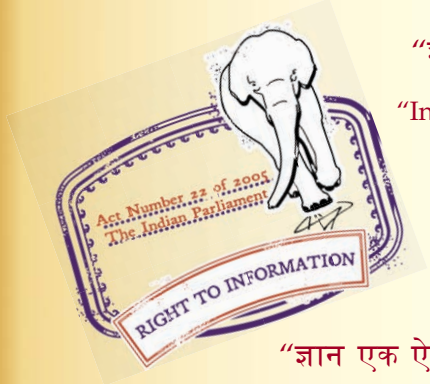
Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 8943 (1978): Guide to be design and use of components intended for mounting on boards with printed wiring and printed circuits [LITD 5: Semiconductor and Other Electronic Components and Devices]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

IS: 8943 - 1978

(Reaffirmed 2004)

Indian Standard

GUIDE TO THE DESIGN AND USE OF COMPONENTS INTENDED FOR MOUNTING ON BOARDS WITH PRINTED WIRING AND PRINTED CIRCUITS

UDC 621·3·049·75 - 218 (036) : 621·38/·39·038

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Price Rs 10·00 Gr 6

January 1979

Indian Standard

GUIDE TO THE DESIGN AND USE OF COMPONENTS INTENDED FOR MOUNTING ON BOARDS WITH PRINTED WIRING AND PRINTED CIRCUITS

Printed Circuits Sectional Committee, LTDC 17

Chairman	*Representing*
SHRI D. K. SACHDEV	Indian Telephone Industries Ltd, Bangalore
Members	
SHRI M. S. JAYASIMHA (*Alternate* to Shri D. K. Sachdev)	
DR H. C. BHASIN	Formica India Ltd, Pune
SHRI V. K. HINGNE (*Alternate*)	
SHRI M. H. KINI	Electronic Component Industries Association, New Delhi
COL C. D. MALANEY	Ministry of Defence (LCSO)
SHRI C. K. V. RAO (*Alternate*)	
SHRI P. M. MENON	Hindustan Aeronautics Ltd, Hyderabad
SHRI S. SRINIVASAN (*Alternate*)	
SHRI A. K. MISRA	Directorate General of Civil Aviation, New Delhi
SHRI V. MITTER	Hegde & Golay Ltd, Bangalore
SHRI K. P. KARANTH (*Alternate*)	
SHRI A. S. NARAYANA	Bakelite Hylam Ltd, Hyderabad
SHRI J. S. KALAMBI (*Alternate*)	
SHRI A. A. PATANKAR	Bhabha Atomic Research Centre, Bombay
SHRI P. B. DESHPANDE (*Alternate*)	
SHRI K. RADHAKRISHNAN	Rao Insulating Co Pvt Ltd, Bangalore
SHRI P. VAZIR KHAN (*Alternate*)	
REPRESENTATIVE	Electronics Corporation of India Ltd, Hyderabad
REPRESENTATIVE	Posts and Telegraphs Department, New Delhi
SHRI M. K. SADAGOPAN	Bharat Electronics Ltd, Bangalore
DR S. L. SARNOT	Department of Electronics, New Delhi
DR J. VAID	Philips India Ltd, Bombay
SHRI M. A. GODEBOLE (*Alternate*)	
SHRI N. SRINIVASAN, Director (Electronics)	Director General, ISI (*Ex-officio Member*)

Secretary

SHRI A. S. RAWAT
Assistant Director (Electronics), ISI

Indian Standard

GUIDE TO THE DESIGN AND USE OF COMPONENTS INTENDED FOR MOUNTING ON BOARDS WITH PRINTED WIRING AND PRINTED CIRCUITS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 19 September 1978, after the draft finalized by the Printed Circuits Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 The object of this standard is to provide guidance to the designer, manufacturer and user of components suited for use with printed circuits so that the components may contribute to more efficient and reliable design and manufacture of printed circuit assemblies of compact form.

0.3 While preparing this standard, assistance has been derived from the following publications and documents issued by International Electrotechnical Commission:

IEC Pub 321-1970 Guidance for the design and use of components intended for mounting on boards with printed wiring and printed circuits

IEC Doc : 52 (Central Office) 133 Second draft — Revision of IEC Publication 286 : Packaging of components on continuous tapes

0.4 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

---

1. SCOPE

1.1 This standard gives guidance to the designer, manufacturer and user of printed circuits assembly on matters related to the specification, design, production, supply and application of components suited for use with printed circuits.

*Rules for rounding off numerical values (*revised*).

1.1.1 This standard is intended to be applied to components which are to be soldered on to printed circuits.

2. TERMINOLOGY

2.1 For the purpose of this standard, the following definition in addition to those given in IS : 1885 (Part VI)-1978* shall apply.

2.1.1 *Maximum Height of a Component* — The maximum distance from the surface of the mounting board to: (a) the top level of the component, or (b) the top level of the mounting device if this is higher, when the component is mounted in accordance with the normal mounting instructions. For plug-in-devices the height includes that of both parts when mated.

3. GENERAL

3.1 A component that is to be mounted on a printed wiring or circuit board has to fulfil a number of specialized requirements in order to permit efficient manufacture of the assembly and to assure the quality that is demanded.

3.1.1 The application of printed wiring and circuits with their unique co-planer component mounting and wiring surfaces affects not only the performance of the product but also the design and manufacturing methods to be adopted.

3.1.2 Besides the normal electrical performance and quality requirements of the components, there are some specialized physical and mechanical features to be considered. Packaging of components is often affected because of the different manufacturing methods adopted for assemblies using printed wiring as compared with those conventional assemblies using ordinary wiring methods.

3.2 If the design requirements of components are to be appreciated, the primary features of the board to be considered are:

a) type of board (single or double clad);

b) board dimensions (in particular the board thickness);

c) hole dimensions;

d) hole locations;

e) hole type (plain or plated-through).

Other general features which may influence component design are:

f) the distance between boards in some types of chassis assembly;

g) the desire to secure effective use of the space (volume as well as board surface area) on the component side;

*Electrotechnical vocabulary : Part VI Printed circuits.

h) the requirement to match the component density with the connection density in order to achieve a coherent electronic assembly.

NOTE 1 — Information on these features is contained in IS : 7405 (Part I)-1973*.

NOTE 2 — The foregoing features are but a few of the many derived which need to be considered and which are set out by this standard.

4. FACTORS RELATED TO THE MOUNTING OF COMPONENTS ON THE BOARD

4.1 In principle, no preparation of components specially designed for printed wiring should be necessary before mounting (insertion).

4.2 If a component is not exclusively made for printed wiring application, but can be made usable for it by bending the wire terminations in the appropriate way, or if the component is meant to act as an adjustable bridging connection as well, it should be possible to bend or form the terminations without damaging the component and/or its terminations. Whilst the preferred method is to grip the wires firmly during bending, other methods used and the corresponding requirements are given in Appendix A for guidance.

4.3 If polarizing is necessary for components with two terminations, it should be effected by one or more of the following:

a) Visual identification (and, if possible, position in the packing);

b) Component shape, different sizes and/or shapes of the terminations; and

c) A separate locating device such as a spigot or projection which is not a termination.

4.3.1 Identification marks should be visible independent of mounting mode.

4.3.2 Even where no polarizing is necessary, it is preferable that it should be possible to determine the position of the terminations from the component shape or position marking.

4.4 For components with more than two terminations, it should be possible to insert them in the right way only, preferably, as a result of an asymmetrical arrangement of the terminations. If an asymmetrical arrangement of the terminations is not practicable, then other methods of polarizing given in **4.3** should be provided. In any case, it is preferable that the correct orientation be detectable from the shape, position marking or place in the packing.

*Specification for printed wiring boards : Part I General requirements and tests.

4.5 After insertion of components into the board, it is essential that they be held firmly in place while they are being soldered. This can be arranged by using assembly jigs which will hold the components in position temporarily. Examples of self holding are given below:

a) The terminations may be shaped and dimensioned so that they are a force fit into standard holes [not applicable to mounting on boards having plated-through holes (*see also* **6.10**)].

b) The terminations may be designed to exert a spring fit in the mounting holes (*see also* **6.11**).

c) After insertion, the wires or terminations may be swaged or bent over on the other side of the board (*see also* **6.6**).

d) The component may have integral mounting means other than by the terminations.

e) The component may be fixed by separate mounting devices.

f) The component is held in place by its own weight.

4.6 The terminations should have a smooth surface finish and be free of lacquer, wax, extraneous tin and solder, burrs and other dirt or damage that could hamper the proper functioning of cutting or forming tools as well as insertion and soldering operations. (In cases where terminations cannot be as clean as required over the complete length, the manufacturer should state the zone in which the requirements are not fulfilled; for this zone a maximum length of 1·5 mm is specified). Soldering should be possible without any additional surface treatment of the terminations.

4.6.1 Terminations liable to come into direct contact with the solder bath must not be allowed to contain certain metals or alloys, for example, zinc, cadmium or brass, likely to have a harmful effect on the solder bath.

4.7 If a component is specially designed for use with printed circuits, the size, shape and position of the terminations of the component and the relevant tolerances on these should be such that the terminations will readily fit into the specified pattern of holes in the printed board.

4.7.1 For hole locations and sizes, including tolerances, *see* IS : 7405 (Part I)-1973*.

The size and position of the holes in the printed board or of the terminations of the component (including all tolerances) should be checked by suitable gauging or other methods.

NOTE — Such information on components could conveniently be provided by component suppliers in their data sheets.

*Specification for printed wiring boards : Part I General requirements and tests.

4.8 If a component is specially designed for use with printed circuits, and is required for mechanized assembly, the terminations should be accurately located in the body of the component with respect to reference planes, holes, notches or other suitable locating means on the body.

5. FACTORS RELATED TO THE OVERALL DIMENSIONS OF COMPONENTS

5.1 General — In printed circuit assemblies, optimum packing density of components can be achieved only by using components with consistent height dimensions. It will be appreciated that for different classes of application, different heights will be necessary to meet this requirement.

5.2 Preferred Series of Maximum Heights

2·5, 5·0, 8·0, 10·5, 13·5, 16·5, 20·0, 25·0 mm.

For values above 25 mm an incremental step of 5 mm is adopted up to a value of 50 mm.

6. OTHER FACTORS RELATED TO THE COMPONENT DESIGN

6.1 The small portions of the components base should act as a spacer providing a positive clearance for the remainder of the component when the portion of the base acting as the spacer is in firm contact with the surface of the printed board. The projections to act as spacers should be non-metallic and should not enclose the terminal area, thus permitting fumes and flux substances to escape during the soldering operation. The base of the components designed for printed circuits should preferably be insulated.

Alternatively, suitably shaped terminations may be used to meet these requirements.

6.2 The component and terminations should be capable of withstanding the soldering conditions given in **9**. In particular, the materials used for the component should be such that it will not be contaminated or changed in shape during the fluxing, the subsequent drying and the soldering operations. Care should be taken that the flux does not enter into the body and prevent proper operation of the component.

6.3 Components and terminations should be capable of withstanding normal cleaning operation during use and soldering. Resistance to cleaning solvent is checked in according with **6.4.10** of IS : 7405 (Part I)-1973*.

*Specification for printed wiring boards : Part I General requirements and tests.

6.4 For components with high heat dissipation, precautions should be taken in the design to allow for the maximum working temperature for which the board will be suitable (*see* relevant part of IS : 5921*).

6.5 In the design of components, ergonomic aspects (factors relating to work economy) should be considered, for example, the provision of small ridges on the component body to enable the assembly operator to sense the orientation of the component by touch. The insertion force should be such that the component can be assembled conveniently with the fingers.

6.6 Components with terminations intended to be bent after insertion, in order to secure the component to the board, should be capable of being bent readily by a tool under the conditions shown in Appendix B without being damaged.

6.7 The size of terminations should be such as to suit a specific hole size with associated tolerances given in **6.4.2.2** of IS : 7405 (Part I)-1973†. Termination sizes should be made as small as practicable and consistent with the mechanical and electrical requirements of the component and the class of board (if known).

6.8 The length of the terminations should be suitable for one or more of the standard board thicknesses including the tolerances permitted [*see* IS : 7405 (Part I)-1973†].

6.9 Where neccssary, the length of the terminations should allow for bending over on the side opposite the component; the length protruding should then be dependent upon the wire diameter. Terminations which are not intended to be bent over should protrude just sufficient to allow making a good solder joint. For many applications, a protruding length of the order of 1 mm would be suitable.

6.10 Pluggable terminations of the non-resilient type should not delaminate or otherwise damage the board when the components are inserted. (This type of termination is not recommended for printed boards having plated-through holes.)

NOTE — For high reliability, pluggable terminations may not be used.

6.11 Terminations which are shaped to hold the component in place by a spring fit, prior to soldering, should be capable of holding the component in the defined position and preventing movement of the component during soldering operations.

6.12 Heavy components should have separate fixing devices. Alternatively, such components should have stout terminations with a positive

*Specification for metal-clad base material for printed circuits for use in electronic and telecommunication equipment.

†Specification for printed wiring boards : Part I General requirements and tests.

grip on the side of the board away from the component so that the soldered joint is not strained when subjected to shock, vibration, etc.

6.12.1 The weight limits depend upon the size and number of terminations, the component shape and dimensions, environmental conditions, and also upon the ratio of the distance of the centre of gravity from the mounting surface to the minimum distance between the terminations.

6.12.2 Although general rules cannot be given, it may be possible to mount components with a weight of 7 g per termination without separate fixing devices. In any case, environmental conditions have to be taken into account and may influence this weight limit.

6.13 In the design of terminations, the soldering times and temperatures given in **9** should be taken into account.

6.13.1 Terminations with a large mass of metal may not reach soldering temperatures during mass soldering. The heat capacity of parts of the component in contact with the terminations should also be taken into consideration.

6.14 Terminations should be as widely spaced as possible without increasing the overall component size and as consistent with the component properties.

6.15 The termination layout (*see also* **4.7**) is also influenced by the fact that, on printed boards, lands are normally used.

6.15.1 Land sizes are determined by factors such as the size of component wires or terminations, their shape and solderability requirements.

6.15.2 Typical land sizes are given for guidance in Table 1 for components designed for normal class boards. Lands may be smaller on fine tolerance class boards or where plated-through holes are used.

6.15.3 Insulating spaces are therefore related to the spaces between the lands and not to the spaces between the edges of the terminations. The spaces may further be modified by requirements to work under severe environmental conditions and by the requirements to prevent solder bridging during soldering operations. Guidance for the selection of minimum conductor spacings on printed boards for various voltage ranges is given in IS : 7405 (Part I)-1973*.

6.16 Where space permits, it should be possible to determine the marked values of components when mounted in the normal way (*see also* **4.3**).

*Specification for printed wiring boards : Part I General requirements and tests.

TABLE 1 TYPICAL LAND SIZES FOR COMPONENTS FOR NORMAL CLASS BOARD

(*Clause* 6.15.2)

NOMINAL HOLE DIAMETER	MINIMUM LAND DIAMETER FOR NORMAL CLASS BOARD
mm	mm
0·6	1·8
0·8	2·3
1·0	2·5
1·3	2·8
1·6	3·1
2·0	3·5

6.17 Any adjusting device, fixing straps, etc, should be accessible, for example, from a direction perpendicular or parallel (not preferred unless intended to be mounted at edge of board as a control) to the board. It is desired that the adjusting devices should not be positioned so that they can only be operated through a hole in the board.

7. EXTERNAL CONNECTION TO OTHER SECTIONS OF THE EQUIPMENT

7.1 General — The ends of termination members for external connections of all kinds should meet the requirements specified for other components; in particular **4.5**, **4.6**, **4.7**, **5** and **6** shall apply for the design of the end fitted to the printed boards.

7.2 Single Point Connection Terminations — The fixing methods for single point termination devices should be designed to prevent damage to the soldered joint, the conductor land, the base material and the adhesive bond due to the normal stresses applied in connecting and disconnecting the external wires. In most cases, the use of an additional fixing tongue or spigot is preferred; the two fixing points should be on the standard grid. Test sockets or plug members also should meet these requirements.

7.2.1 Terminations with clamping screws should be designed so that the screws are not affected by flux or solder during mass soldering.

7.3 Multipoint Connection Termination Assemblies

7.3.1 Polarizing should be effected and gauging should be carried out in accordance with **4.3**, **4.7** and **4.8**.

7.3.2 Additional fixing other than that provided by the terminations should be provided. This is particularly important for plug or socket assemblies where high insertion and withdrawal forces may be experienced.

7.4 Edge Board Contacts and Sockets

7.4.1 The shape and size of edge board contacts and the insulating spaces between them will be dependent not only upon the requirements of current rating, the working voltage between adjacent contact and insulation resistance between contacts but also on the edge connector sockets be used.

7.4.1.1 Current ratings may require modifications to allow for localised heating at the point of contact, plating on the contact surface and pressure and other design features of the socket contacts.

7.4.2 The design of edge connector sockets should be such that tolerances applicable to the pattern of edge board contacts are taken into consideration. In Appendix C tolerances applicable to fine tolerance class etched printed boards are given.

7.4.2.1 For general tolerances, reference may be made to IS: 7405 (Part I)-1973*.

7.4.2.2 Contacts and locating or polarizing slots when used should preferably be on the standard grid.

7.4.3 In the design of the edge connector socket, due allowance should be made for variations in the thickness of the board material, variations in the plating thickness, bow along the length of engagement of the board and variations in the length due to environmental effects on the board material.

7.4.4 The number of insertions which the printed contacts shall withstand may be seriously limited unless the socket contact design is correct.

7.4.4.1 Contacts which are designed to present their edges or other sharp projections to the board contact surface are deprecated due to the danger of cutting the thin copper layer.

7.4.5 The edge connector socket contacts should be so shaped that, when the board is inserted into the connector, there is no danger of lifting the exposed edges of the copper layer on the board.

7.4.6 If the edge connector socket contact pressure is designed to be high, it is possible to fit reinforcing shoes or contacts to the board face or to apply suitable plating to the edge board contact. Where reinforcing shoes or contacts are used, they should be soldered to the circuit pattern but should be designed so that the forces arising during insertion and withdrawal from the socket are not transmitted to the copper or the adhesive bond.

*Specification for printed wiring boards : Part I General requirements and tests.

8. PACKING

8.1 Delivery of components in suitable packing is preferred if they are to be handled by machines (so that hopper feeders can be avoided). For packaging of components on continuous tapes, *see* Appendix D.

8.2 Components with terminations having different electrical functions should be positioned in the same way in the packing.

9. SOLDERING, SOLDERABILITY AND HEAT SHOCK

9.1 To consider the possible effects of soldering conditions upon the component and its terminations as well as the requirements for solderability of the latter, the following factors should be noted:

a) The highest temperature and longest time allowed for soldering which the component is expected to withstand according to the relevant heat shock requirements of IS : 7405 (Part I)-1973*.

b) The lowest temperature and shortest time which represent in worst soldering conditions under which good soldered connections will result. These conditions will be found in IS : 589-1961†.

c) In general, practical soldering conditions for printed circuits are within the range between (a) and (b) above. A typical condition for mass soldering is 250°C for a time between 2 seconds and 5 seconds. For iron soldering an extreme condition may be 400°C for 1 second.

10. CLEANING

10.1 Solvent Cleaning — The use of solvents, for example, trichloroethylene, should be taken into account. Where components or marking will not withstand solvent cleaning, the component supplier should draw attention to the fact. For the methods for the checking of solvent resistance, *see* **6.4.10.1** of IS : 7405 (Part I)-1973*.

10.2 Ultrasonic Cleaning — The manufacturer of the component should be prepared to supply information concerning the frequency and the amplitude of the vibration and the time of exposure during ultrasonic cleaning to which he considers the component may be exposed without detrimental effects.

11. RESISTANCE TO PROTECTIVE COATINGS

11.1 The manufacturer of the component should supply information as to which types of coating the component will resist.

---

*Specification for printed wiring boards : Part I General requirements and tests.

†Basic climatic and mechanical durability tests for components for electronic and electrical equipment (*revised*).

APPENDIX A

(*Clause* 4.2)

METHODS OF BENDING, WIRE TERMINATION STIFFNESS TESTS AND INSERTION TEST FOR COMPONENTS

A-0. GENERAL

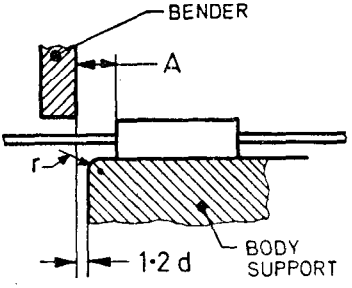
A-0.1 Some of the bending methods and wire termination stiffness and insertion tests are not necessarily applicable to all types of components. The component manufacturer should state which are applicable to the particular type of component.

A-1. METHODS OF BENDING

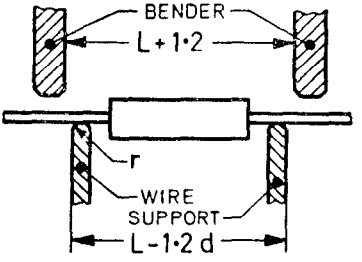
A-1.1 Three types of bending can be distinguished:

a) free bending,
b) supported bending, and
c) clamped bending.

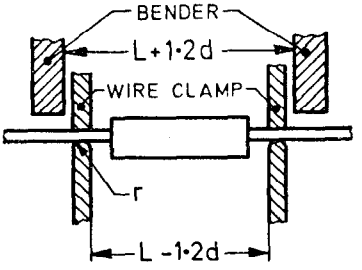
A-1.2 The component manufacturer should state on request which types of bending and what values for the minimum distance 'A' (*see* Fig. 1A) and for the minimum bending radius are applicable.



1A Free Bending



1B Supported Bending



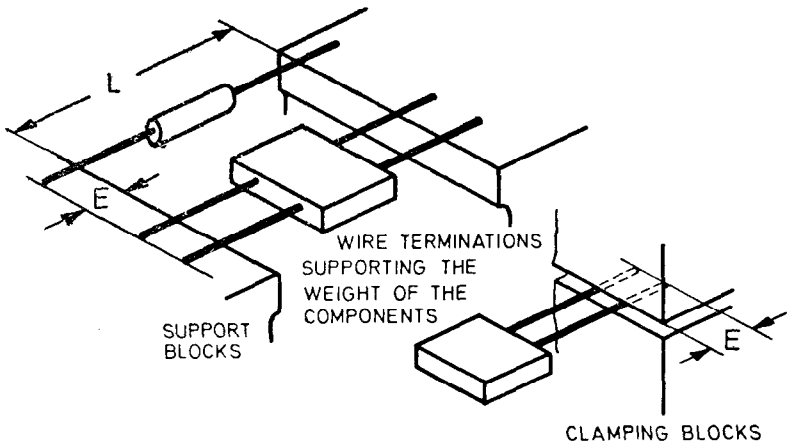
1C Clamped Bending

L = bending pitch
d = diameter of the wire termination
A = minimum distance allowed
r = bending radius

FIG. 1 BENDING

A-2. TESTS

A-2.1 Wire Termination Stiffness Tests — To make efficient preparation and/or assembly possible, the connections should be sufficiently stiff and straight before as well as after preparation. No permanent bending of the terminations should result from the application of the relevant test forces (*see* Fig. 2).



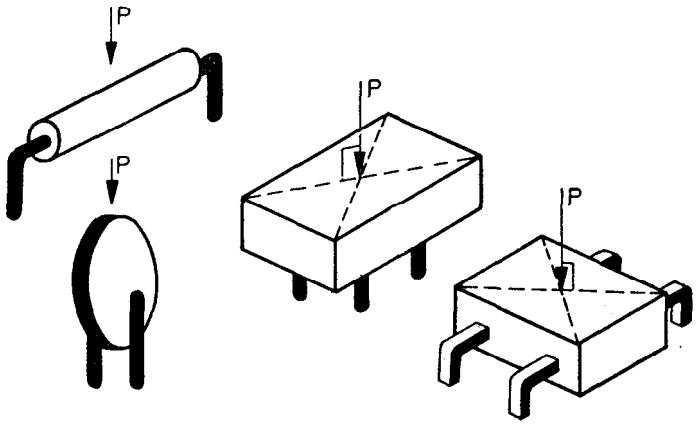
L = overall length over wire minus approximately 12 mm

E = approximately 6 mm

FIG. 2 TESTS TO BE APPLIED BEFORE PREPARATION

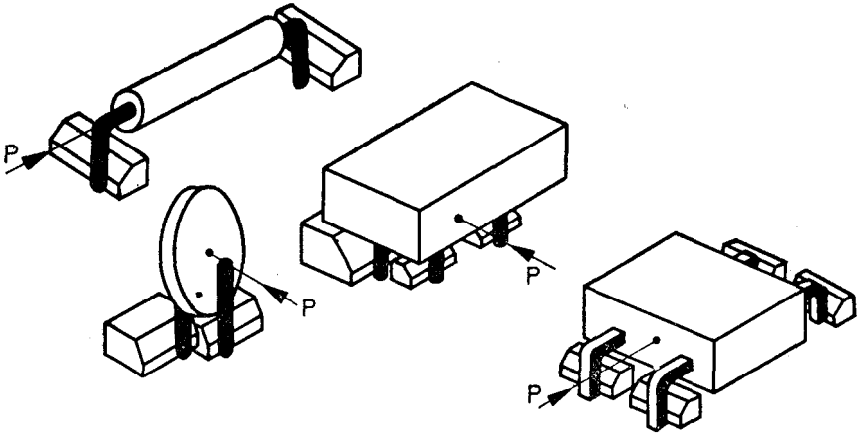
A-2.2 Insertion Test for Mechanized Insertion

A-2.2.1 Component having wire terminations which are parallel to but not located in the centre line or axis of the component body should be tested in accordance with **A-2.2.2.** The component should withstand the test without being damaged (*see* Fig. 3).



NOTE — Additional load P (P = twice the component weight) applied perpendicular to the plane on which the termination ends rest.

3A Perpendicular Force



NOTE — Additional load P (P = twice the component weight) ap plied parallel to the plane on which the termination ends rest.

3B Sidewise Force

FIG. 3 TESTS TO BE APPLIED ON COMPONENTS READY FOR INSERTION

A-2.2.2 The test procedure is such that the component is inserted in holes with a centre distance S (*see* Fig. 4) which is not less than that specified by the component manufacturer. The push rods are lowered so that their lowest point reaches a height B (*see* Fig. 4) above the board.

B is calculated from:

$$B = \frac{D_{min}}{2} - e_{max} + \frac{d}{2}$$

where

B = height above the board of the lowest point reached by the push-rod,

D_{min} = minimum diameter (or minimum height) of component body,

d = diameter of connection lead, and

e_{max} = maximum distance between the centre line of the component body and the centre line of the wire termination.

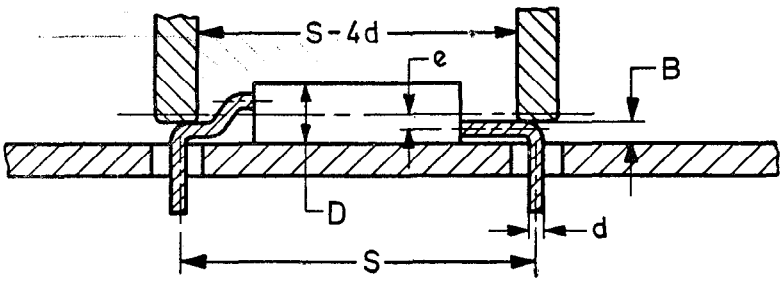


FIG. 4 MECHANIZED INSERTION TEST

APPENDIX B

(*Clause* 6.6)

METHOD OF BENDING

B-1. This method of bending is not necessarily applicable to all types of components. The component manufacturer should state whether the method is applicable to the particular type of component and, if it is, the following information should be given:

a) The maximum hole size (A) (*see* Fig. 5) for which the component is designed [for nominal hole sizes and tolerances thereon, *see* IS : 7405 (Part I)-1973*].

*Specification for printed wiring boards : Part I General requirements and tests.

b) The distance (*B*) (*see* Fig. 5) of bender from the bottom of the component when the thickest base material for which the component is designed is used.

c) The minimum board thickness (*C*) (*see* Fig. 5) for which the component is designed.

NOTE — Where spacers form a functional part of the component, the dimensions *B* and *C* should include the thickness of the spacers.

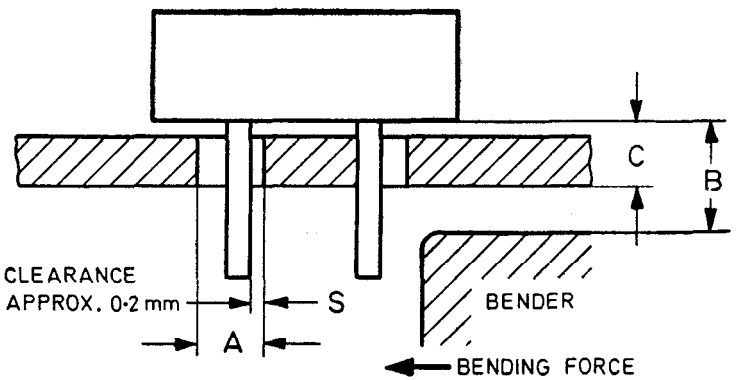


FIG. 5 METHOD OF BENDING

APPENDIX C

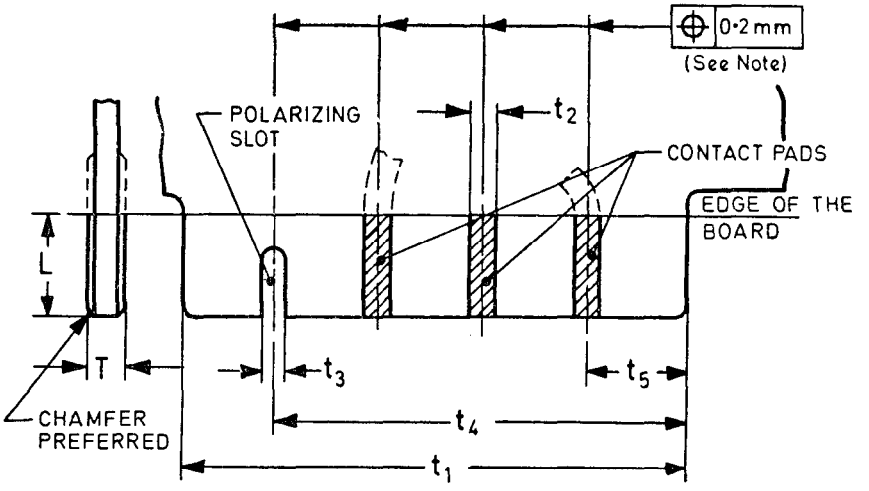
(*Clause* 7.4.2)

TOLERANCES FOR EDGE BOARD CONTACTS

C-1. TOLERANCES FOR EDGE BOARD CONTACTS FOR USE WITH CLOSED-END CONNECTORS

C-1.1 Tolerances shown below (*see* Fig. 6) apply to fine tolerance class etched printed boards.

C-1.2 Deviations t_1, t_2, t_4, and t_5 (*see* Fig. 6) shall apply only to the active Part *L* of the contact pad where it mates with the connector.



NOTE — Deviation ±0·1 mm from the position of the centre line.

FIG. 6 TOLERANCES FOR EDGE BOARD CONTACTS FOR CLOSED-END CONNECTORS

C-1.3 Deviations t_1, t_2, t_3, t_4, t_5, and T shall be as follows:

t_1 = ±0·1 mm for dimensions up to and including 90 mm;

t_1 = ±0·2 mm for dimensions above 90 mm up to and including 152 mm;

t_2 = ± 0·1 mm for spacing exceeding 2·54 mm, this deviation may be ± 0·2 mm where the connector specification allows;

t_3 = ± 0·1 mm;

t_4 = ± 0·1 mm; and

t_5 = ± 0·1 mm.

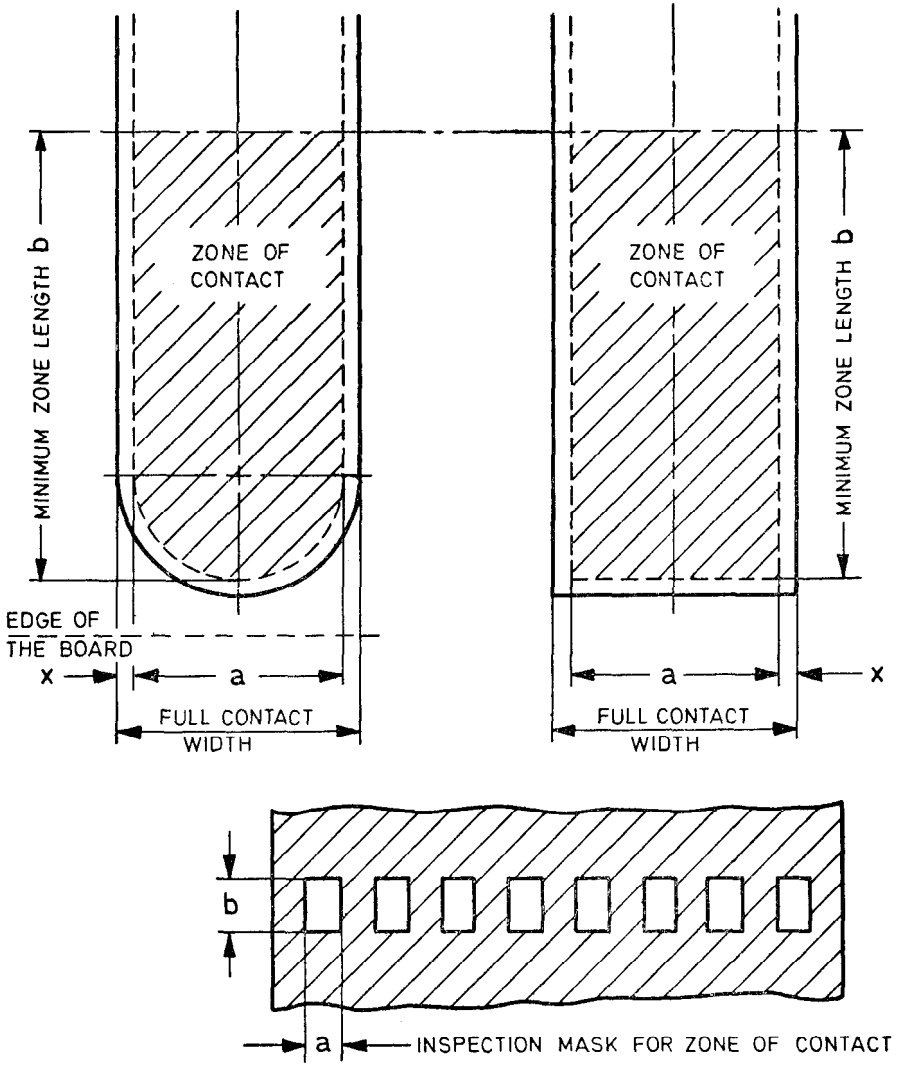
T includes thickness variation as in relevant specification for metal-clad base materials and any additional thickness due to plated-on metals. T should not be outside the values in the table below:

Nominal Board Thickness mm	*Total Board Thickness*, mm	
	T_{min}	T_{max}
0·8 0·7	0·67	0·93
1·6 1·5	1·42	1·78

NOTE 1 — The thicknesses 0·8 mm and 1·6 mm are to be used with plain holes.

NOTE 2 — The thicknesses 0·7 mm and 1·5 mm are to be used with plated-through holes, if necessary.

C-1.4 Attention is drawn to the requirements for the zone of contact given in **6.4.7** of IS : 7405 (Part I)-1973*. The exact configuration of the contact zones of printed edge board contacts is given in Fig. 7.

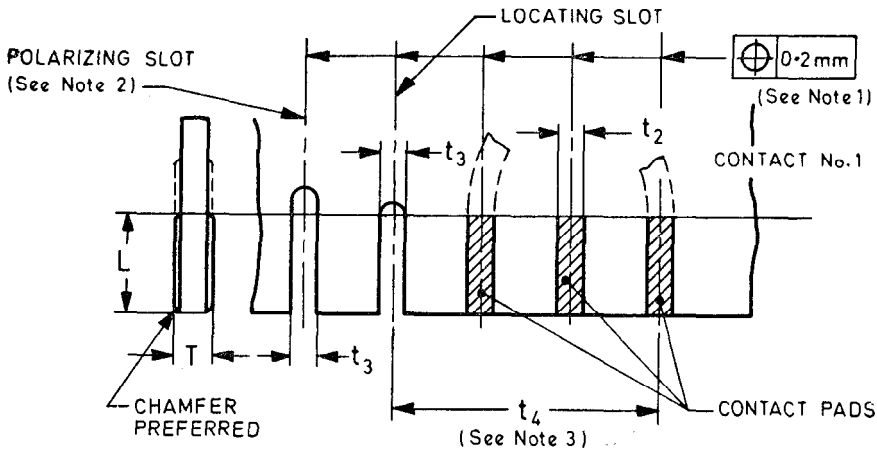


$X = 0{\cdot}25$ mm for 35 m copper foil unless otherwise specified.

FIG. 7 ZONE OF CONTACT

*Specification for printed wiring boards : Part I General requirements and tests.

C-2. TOLERANCES FOR EDGE BOARD CONTACTS FOR USE WITH OPEN-END CONNECTORS (*see* Fig. 8)



NOTE 1 — Deviation $\pm 0{\cdot}1$ mm from true position of the centre lines.

NOTE 2 — Polarizing slot may replace any contact pad.

NOTE 3 — Deviation t_4 applies to the dimension between contact pad No. 1 and the locating slot.

NOTE 4 — For numerical values and other details, *see* **C-1.1**.

FIG. 8 TOLERANCES FOR EDGE BOARD CONTACTS FOR OPEN-END CONNECTORS

APPENDIX D

(*Clause* 8.1)

PACKAGING OF COMPONENTS ON CONTINUOUS TAPES

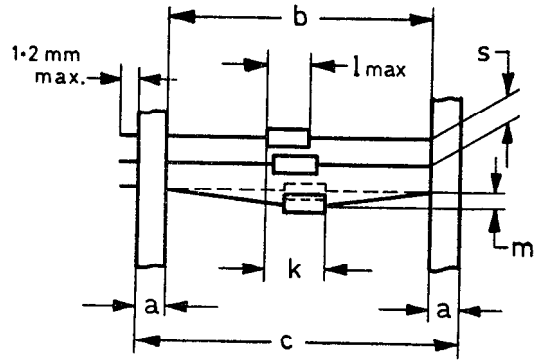
D-1. GENERAL

D-1.1 This relates to the packaging of components, with axial leads, to facilitate assembly or automatic insertion. The object is to standardize the methods, general dimensions and preferred tolerances for the taping of these components, for example, resistors, capacitors, diodes, etc, for use in assembly of electronic and telecommunication equipments.

D-1.2 The appendix deals only with the lead taping type of packaging and does not indicate the dimensions of the components themselves.

D-2. DIMENSIONS

D-2.1 Lead Taping of Packaging



Standard Spacing Between Components (s)	Maximum Component Body Diameter	Permissible Deviations Over Ten Spacings
mm	mm	mm
5 ± 0·5	Up to 4·9	± 2
10 ± 0·5	4·9 to 9·8	± 2
15 ± 0·75	9·8 to 14·5	± 3
20 ± 1·00	14·5 to 19·0	± 4

Standard Widths of Tape (a)
mm
6 ± 1
9 ± 1

NOTE — Overlapping between standard spacing and body diameter may occur but the probability of coincidence of the lower limit of spacing with the maximum body diameter seems low.

FIG. 9 LEAD TAPING OF PACKAGING

D-2.1.1 *Body Location (Permissible Lateral Deviation)* — Dimension k, being the width of the window in which the component body shall be located, shall be 1·4 mm wider than the maximum length (l_{max}) of the component body. Maximum body length is body length measured from clean lead to clean lead as specified in the relevant component specification. The window shall be located centrally between the tapes.

D-2.1.2 *Tape Spacing* — Maximum tape spacing 'c' shall not exceed 140 mm; its value is chosen in relation to the component dimensions. According to Fig. 9, the inner tape spacing 'b' is equal to the total length of the component (including the length of the wire terminations) from

which the width of both tapes used and the lengths of wire protruding beyond the tapes are subtracted. For certain applications the following tape spacings, based on 6 mm tape width, are commonly used:

Inner Tape Spacing, b
53 ± 2
63 ± 2
73 ± 2

D-2.2 Taping — The following requirements for axial components shall be met as appropriate (*see* Fig. 9):

a) All polarized components must be oriented in one direction, the anode lead tape shall be white and the cathode lead tape shall be coloured. Preferred colour is blue.

b) The wire leads shall be free from kinks and bends.

c) The methods of positioning the components or wires on the tape shall be such that the component leads are not nicked or otherwise damaged.

d) Leads shall not be bent beyond 1·50 mm from their nominal position when measured from the leading edge of the component lead at the inside tape edge and at the lead egress from the component (*see* dimension *m*).

e) The ends of the leads shall preferably not protrude beyond the tapes; if this cannot be avoided lead ends shall not extend beyond the tape by more than 1·2 mm.

f) The components shall be held sufficiently in the tape or tapes so that they cannot come free in normal handling.

g) The adhesive and base of the tapes shall be suitable to withstand storage of the taped components without danger of migration along the lead wires or the giving off of vapours which would make soldering difficult or deteriorate the component properties or lead wires by chemical action, for example, corrosion. In addition, the adhesive shall not become detached so that the components do not remain in position after storage and the base material shall not age sufficiently to lose strength such that it breaks on unreeling when the taped components are fed from the package by hand or into the assembly machines.

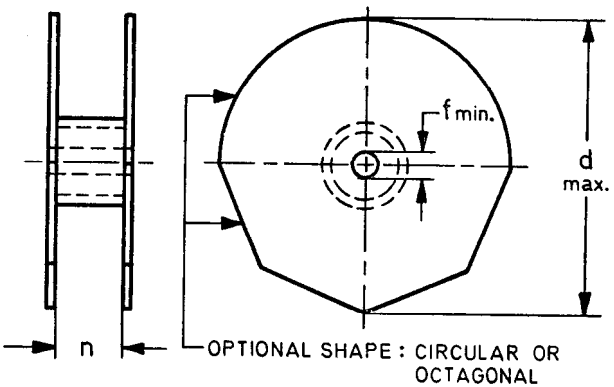
h) Tapes in adjacent layers shall not stick together in the packing.

j) Splices shall be equal in strength to the original tape and shall be not thicker than four times the thickness of a single layer of original tape. Splices shall not be misaligned more than 0·8 mm. When splicing is applied component spacing shall remain within the tolerance as specified in **D-2.1.**

D-3. PACKING

D-3.1 The tapes of components may either be wound on reels or folded, for example, in a concertina arrangement. The unit of packing shall preferably be 100 or multiples thereof. In case of reel packing the following shall apply:

a) *Dimensions of the Reel* — The preferred reel dimensions are shown in Fig. 10.



d_{max} : 400 mm
f_{min} : 14 mm

FIG. 10 OPTIONAL SHAPE FOR REEL : CIRCULAR OR OCTAGONAL

b) The distance '*n*' between the flanges shall be governed by the overall length of the taped component and shall allow proper reeling and unreeling.

c) In order to prevent component damage and lead distortion, protection between layers of components may be provided. Protection material, if applied, shall not cause deterioration of the component or of lead solderability.

d) Quantity of parts shall be controlled so that the taped components and final cover shall not extend beyond the smallest dimension of the flange (in the radial direction).

e) For automatic insertion it is required that the number of empty places in the tape per reel shall not exceed 0·25 percent without consecutive empty places.

D-4. MARKING

D-4.1 When required the number of components shall be marked on one tape at every 50th or 100th component.